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PHYS 252
HW1

2.2

Variable	Best Estimate	Probable Range	
Position, x	53.3	53.1 to 53.5 (cm)	δ = 0.2 cm
Velocity, v	-13.5	-14.0 to -13.0 (cm/s)	δ = -0.5 cm/s
Acceleration, a	93	90 to 96 (cm/s²)	δ = 3 cm/s²

$x_{best} \pm \delta x$

$$\boxed{\begin{array}{l} 53.3 \pm 0.2\text{ cm} \\ -13.5 \pm 0.5\text{ cm/s} \\ 93 \pm 3\text{ cm/s}^2 \end{array}}$$

2.4

a.) $x = 3.323 \pm 1.4$ mm

$\boxed{x = 3.3 \pm 1.4\text{ mm}}$

b.) $t = 1{,}234{,}567 \pm 54{,}321$ s

$\boxed{t = 1234.0 \times 10^4 \pm 5.0 \times 10^4\text{ s}}$

c.) $\lambda = 5.33 \times 10^{-7} \pm 3.21 \times 10^{-9}$ m

$\boxed{\lambda = (533 \pm 3.00) \times 10^{-9}\text{ m}}$

d.) $r = 0.000{,}000{,}538 \pm 0.000{,}000{,}03$ mm

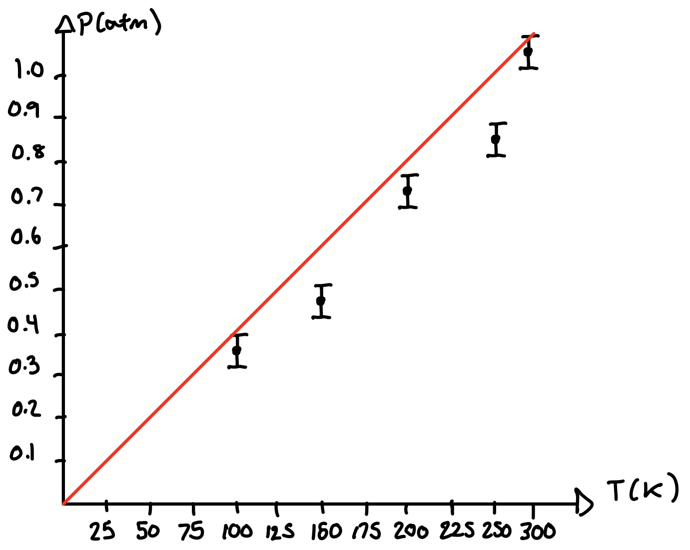
$\boxed{r = (53 \pm 3.0) \times 10^{-8}\text{ mm}}$

2.12

Trial no.	Acceleration a (m/s²)	Expected Acceleration gsinθ (m/s²)	Discrepancies	Uncertainty
1	2.04 ± 0.04	2.36 ± 0.1	-0.32	± 0.14
2	3.58 ± 0.06	3.88 ± 0.08	-0.30	± 0.14
3	4.32 ± 0.08	4.57 ± 0.05	-0.25	± 0.13
4	4.85 ± 0.09	5.05 ± 0.04	-0.20	± 0.13
5	5.53 ± 0.01	5.72 ± 0.03	-0.19	± 0.13

The discrepancies do not lie in the range of the uncertainty so we cannot say a is given by gsinθ

2.15



Since the data is close to or going through the error bars, this is consistent with the claim.

2.23

Meter Stick : $\delta l : \frac{1\,mm}{2} = 0.5\,mm$

$l = 2\,cm$

Error : $\frac{0.5\,mm}{20\,mm} = 0.025 = 2.5\%$

$E = \frac{\delta l}{l}$

$\boxed{\text{The meterstick cannot make this measurement. } 2.5\%}$

Microscope : $\delta l : \frac{0.1\,mm}{2} = 0.05\,mm$

$l = 2\,cm$

Error : $\frac{0.05\,mm}{20\,mm} = 0.0025 = 0.25\%$

$\boxed{\text{The microscope can make this measurement. } 0.25\%}$

2.27

a.) $x = 6.1234 \quad F.u = 2\%$

$6.1234 \cdot (0.02) = 0.122468$

1 sig Fig 0.1

$\boxed{6.1 \pm 0.1,\ 2 \text{ sig Figs}}$

b.) $y = 1.1234 \quad F.u = 2\%$

$1.1234 \cdot 0.02 = 0.022468$

$\boxed{1.12 \pm 0.02,\ 3 \text{ Sig Figs}}$

2.28

a.) $a = 11.5 \pm 0.2\,cm$ $b = 25.4 \pm 0.2\,s$ $q = ab$

$a_{best} \cdot b_{best} = 11.5 \cdot 25.4 = 292.1\ cm \cdot s$

uncertainty in a : $\frac{\delta a}{a_{best}} = \frac{0.2}{11.5} = 0.017391 = 1.739\%$

uncertainty in b : $\frac{\delta b}{b_{best}} = \frac{0.2}{25.4} = 0.007874 = 0.7874\%$

absolute uncertainty : $1.739\% + 0.7874\% = 2.526\%$

$292.1 \times 0.025 = 7.3 \equiv$ uncertainty

$\boxed{q = 292 \pm 7\ cm \cdot s}$

b.) $a = 5.0\,m \pm 7\%$ $b = 3.0\,N \pm 1\%$

$a_{best} \cdot b_{best} = 15\ Nm$

uncertainty in a : $\frac{\delta a}{a_{best}} = \frac{0.35}{5.0} = 0.07 = 7\%$

7% of 5.0 = 0.35

uncertainty in b : $\frac{\delta b}{b_{best}} = \frac{0.03}{3.0} = 0.01 = 1\%$

1% of 3.0 = 0.03

absolute uncertainty : $0.07 + 0.01 = 0.08 = 8\%$

$15\,N \cdot 0.08 = 1.2 \equiv$ uncertainty

$\boxed{q = 15 \pm 1.2\ N \cdot m}$